國立成功大學

112學年度碩士班招生考試試題

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系　所：能源工程國際碩士學位學程

科　目：科技英文

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節　次：第 2 節

備　註：不可使用計算機

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Part 1 (30 points) Choose only 1 correct answer for each question. Each question is worth 2 points.

1. The nuclear energy _____ around the world today to produce electricity is through nuclear fission, while technology to generate electricity from fusion is at the research and development phase.
   (A) harnessed　　　　(B) harnessing　　　　(C) harness　　　　(D) harnesses

2. Wind energy helps avoid 329 million metric tons of carbon dioxide emissions annually, equivalent to 71 million cars worth of emissions that along _____ other atmospheric emissions cause acid rain, smog, and greenhouse gases.
   (A) at　　　　(B) for　　　　(C) with　　　　(D) to

3. Solar radiation is light, also known as electromagnetic radiation, that is _____ by the Sun.
   (A) emits　　　　(B) emitting　　　　(C) emitted　　　　(D) emit

4. Molten salt reactors (MSRs) use molten fluoride salts as primary coolant _____ low pressure.
   (A) to　　　　(B) at　　　　(C) in　　　　(D) on

5. The result of this research is _____ with the findings obtained by the other research team.
   (A) identical　　　　(B) in agreement　　　　(C) the same　　　　(D) equivalent

6. Horizontal axis wind turbines prevail in the wind energy market due to their much _____ efficiency compared to vertical axis wind turbines.
   (A) faster　　　　(B) taller　　　　(C) longer　　　　(D) higher

7. Scientists currently use models in which warming of 1.5°C _____ with carbon dioxide in the atmosphere of between 425 and 520 parts per million (ppm).
   (A) coincides　　　　(B) corresponds　　　　(C) tally　　　　(D) correlated

8. The building sector is one of the key consumers of energy in Europe where energy use in buildings has seen a _____ trend over the past 20 years.
   (A) descending　　　　(B) rising　　　　(C) falling　　　　(D) plummeting

9. Electronic oscillation is a repeating cyclical variation in voltage or current in an electrical circuit, resulting in a _____ waveform.
   (A) exponential　　　　(B) quadratic　　　　(C) linear　　　　(D) periodic

10. Taiwan's National Science and Technology Council (NSTC) has said it plans to fund research into key fusion nuclear technologies, following the announcement of a _____ breakthrough in the field by a California-based team of researchers.
    (A) significant　　　　(B) unexpressive　　　　(C) illusive　　　　(D) unexpected

11. Weibull, Rayleigh distribution and Markov chain model were found suitable to _____ wind speed data for the site. Selection of windy site for wind power generation requires meteorological data for installation of wind generator.
    (A) predict　　　　(B) protect　　　　(C) provoke　　　　(D) pretend

12. In aerodynamic modeling blade element moment theory is used for calculation of aerodynamic forces _____ on the rotor blade.

(A) moving　　　　　(B) acting　　　　　(C) searching　　　　　(D) holding

13. Static reactive power compensator is used to improve stability of large wind farms. Parato analysis and simulation models are used to _____ grid-related problems.

(A) absorb　　　　　(B) declare　　　　　(C) analyze　　　　　(D) climb

14. Wind field modeling is an _____ part of a structural analysis of wind turbines.

(A) important　　　　(B) humid　　　　　(C) windy　　　　　(D) radiant

15. Aeroaccoustic tests _____ used to find noise in the aerofoil.

(A) be　　　　　　　(B) is　　　　　　　(C) has　　　　　　　(D) are

Part 2 (30 points) Read the article and choose 1 correct answer to each question. Each question is worth 3 points.

Article: Kruitwagen, L., Story, K.T., Friedrich, J. *et al.* A global inventory of photovoltaic solar energy generating units. *Nature* 598, 604–610 (2021). https://doi.org/10.1038/s41586-021-03957-7

"Photovoltaic (PV) solar energy generating capacity has grown by 41 per cent per year since 2009. Energy system projections that mitigate climate change and aid universal energy access show a nearly ten-fold increase in PV solar energy generating capacity by 2040. Geospatial data describing the energy system are required to manage generation intermittency, mitigate climate change risks, and identify trade-offs with biodiversity, conservation and land protection priorities caused by the land-use and land-cover change necessary for PV deployment. Currently available inventories of solar generating capacity cannot fully address these needs. Here we provide a global inventory of commercial-, industrial- and utility-scale PV installations (that is, PV generating stations in excess of 10 kilowatts nameplate capacity) by using a longitudinal corpus of remote sensing imagery, machine learning and a large cloud computation infrastructure. We locate and verify 68,661 facilities, an increase of 432 per cent (in number of facilities) on previously available asset-level data. With the help of a hand-labelled test set, we estimate global installed generating capacity to be 423 gigawatts (−75/+77 gigawatts) at the end of 2018. Enrichment of our dataset with estimates of facility installation date, historic land-cover classification and proximity to vulnerable areas allows us to show that most of the PV solar energy facilities are sited on cropland, followed by arid lands and grassland. Our inventory could aid PV delivery aligned with the Sustainable Development Goals. A global inventory of utility-scale solar photovoltaic generating units, produced by combining remote sensing imagery with machine learning, has identified 68,661 facilities — an increase of over 400% on previously available asset-level data — the majority of which were sited on cropland."

16. The main discussion point of the article is the facilities of...

    (A) nuclear energy　　　(B) fossil fuel　　　(C) photosynthesis　　　(D) solar energy

17. Based on the statistical data provided by this article, the growth of PV solar energy industry is...

    (A) deteriorating　　　(B) promising　　　(C) disappointing　　　(D) upsetting

18. The term "ten-fold" is used in the article. Which of the following best describes this term?

    (A) power of 10　　　(B) 10%　　　(C) 100%　　　(D) 1000%

19. Which of the following methodologies is NOT directly used in this study?

    (A) remote sensing　　　(B) linear regression　　　(C) cloud computation　　　(D) machine learning

20. Which of the following is one of the needs to be addressed by solar generating capacity as mentioned in the article?

    (A) manage profitability　　　　　　　(B) mitigate air pollution

    (C) identify trade-offs with gender inequality　　　(D) land protection

21. Which of the following energy facilities is included in the study presented by the article?

    (A) The 900 megawatts offshore windfarm at Changhua, Taiwan

    (B) The 510 megawatts concentrated solar power plant at Ouarzazate, Morocco.

    (C) The 14 gigawatts Itaipu Dam at the border of Brazil and Paraguay.

    (D) The 24 megawatts solar array on top of the Tesla Gigafactory at Nevada, USA.

22. Which of the following falls within the estimated global installed generating capacity of PV solar energy by the end of 2018?

    (A) 330 gigawatts　　　(B) 500 gigawatts　　　(C) 540 gigawatts　　　(D) 300 gigawatts

23. Dataset enrichment done in the research presented in this article could potentially help answering the following questions, EXCEPT...

    (A) When were those facilities installed?

    (B) What are the land use classification changes over time?

    (C) How many people were being displaced to accommodate the installation of the facilities?

    (D) Are there any forests close to the facilities?

24. In the ascending order, which type of land is most commonly used for PV solar energy facilities?

    (A) cropland, arid lands, and grassland.

    (B) arid lands, cropland, and grassland.

    (C) grassland, arid lands, and cropland.

    (D) grassland, cropland, and arid lands.

25. Which of the following best describe the main contribution of this article?

    (A) promote awareness on the importance of renewable energy.

    (B) educate the public regarding the severity of climate change.

    (C) provide a database on the medium to large scale PV solar energy facilities.

    (D) provide a solid justification for the use of PV solar energy.

Part 3 (20 points) Read the following paragraphs and choose 1 correct answer to each question. Each question is worth 4 points.

Article: G. M. Joselin Herbert *et al.* A review of wind energy technologies. *Renewable and Sustainable Energy Reviews* 11, 1117–1145 (2007). https://doi.org/10.1016/j.rser.2005.08.004

The wind turbine technology has a unique technical identity and unique demands in terms of the methods used for design. Remarkable advances in the wind power design have been achieved due to modern technological developments. Since 1980, advances in aerodynamics, structural dynamics, and "micrometeorology" have contributed to a 5% annual increase in the energy yield of the turbines. Current research techniques are producing stronger, lighter and more efficient blades for the turbines. The annual energy output for turbine has increased enormously and the weights of the turbine and the noise they emit

have been halved over the last few years. We can generate more power from wind energy by establishment of more number of wind monitoring stations, selection of wind farm site with suitable wind electric generator, improved maintenance procedure of wind turbine to increase the machine availability, use of high capacity machine, low wind regime turbine, higher tower height, wider swept area of the rotor blade, better aerodynamic and structural design, faster computer-based machining technique, increasing power factor and better policies from Government.

Even among other applications of renewable energy technologies, power generation through wind has an edge because of its technological maturity, good infrastructure and relative cost competitiveness. Wind energy is expected to play an increasingly important role in the future national energy scene. Wind turbines convert the kinetic energy of the wind to electrical energy by rotating the blades. Greenpeace states that about 10% electricity can be supplied by the wind by the year 2020. At good windy sites, it is already competitive with that of traditional fossil fuel generation technologies. With this improved technology and superior economics, experts predict wind power would capture 5% of the world energy market by the year 2020. Advanced wind turbine must be more efficient, more robust and less costly than current turbines. Ministry of Non-conventional Energy Sources (MNES), Indian Renewable Energy Development Agency (IREDA) and the wind industry are working together to accomplish these improvements through various research and development programs. This article gives a brief overview of various wind turbine technologies.

26. What are some ways that modern technology has contributed to advances in wind power design?
    (A) Aerodynamics, structural dynamics, and "micrometeorology"
    (B) Improved maintenance procedures for wind turbines
    (C) The establishment of more wind monitoring stations
    (D) All of the above

27. How have the weight and noise emitted by turbines changed in recent years?
    (A) They have both doubled due to the use of high capacity machines.
    (B) They have both tripled due to the use of low wind regime turbines.
    (C) They have both quadrupled due to the use of higher tower heights.
    (D) They have both been halved due to technological developments.

28. The word "enormously" in the passage is closest in meaning to
    (A) insignificant
    (B) compact
    (C) Tremendously
    (D) genuinely

29. How much electricity is expected to be supplied by wind by the year 2020, according to Greenpeace?
    (A) 5%
    (B) 10%
    (C) 15%

(D) 20%

30. Who is working to improve wind turbine technology in India?

(A) Ministry of Non-conventional Energy Sources

(B) Indian Renewable Energy Development Agency

(C) The wind industry

(D) All of the above

Part 4 (20 points) Read the following paragraphs and choose 1 correct answer to each question. Each question is worth 4 points.

Earth has abundant water in its oceans but very little carbon dioxide in its relatively thin atmosphere. By contrast, Venus is very dry and its thick atmosphere is mostly carbon dioxide. The original atmospheres of both Venus and Earth were derived at least in part from gases spewed forth, or outgassed, by volcanoes. The gases that emanate from present-day volcanoes on Earth, such as Mount Saint Helens, are predominantly water vapor, carbon dioxide, and sulfur dioxide. These gases should therefore have been important parts of the original atmospheres of both Venus and Earth. Much of the water on both planets is also thought to have come from impacts from comets, icy bodies formed in the outer solar system.

In fact, water probably once dominated the Venusian atmosphere. Venus and Earth are similar in size and mass, so Venusian volcanoes may well have outgassed as much water vapor as on Earth, and both planets would have had about the same number of comets strike their surfaces. Studies of how stars evolve suggest that the early Sun was only about 70 percent as luminous as it is now, so the temperature in Venus' early atmosphere must have been quite a bit lower. Thus water vapor would have been able to liquefy and form oceans on Venus. But if water vapor and carbon dioxide were once so common in the atmospheres of both Earth and Venus, what became of Earth's carbon dioxide. And what happened to the water on Venus?

31. The word "abundant" in the passage is closest in meaning to

(A) plentiful

(B) absent

(C) uncommon

(D) sparse

32. What is the main way in which Venus and Earth are different from each other, according to paragraph 1?

(A) Whether carbon dioxide was present in their original atmospheres

(B) How thin their original atmospheres were

(C) What their present-day atmospheres mainly consist of

(D) How long ago they first developed an atmosphere

33. Why does the article mention "present-day volcanoes on Earth"?

(A) To provide an example of an important difference between present-day Venus and present day Earth

(B) To help explain why Earth's atmosphere still contains traces of sulfur dioxide but Venus' does not

(C) To indicate one source of information about the likely composition of the original atmospheres of Venus and Earth

(D) To account for the fact that Earth's water supply no longer comes primarily from impacting comets

34. What is one reason mentioned in paragraph 2 for believing that Venus once had large amounts of water?

(A) Because of Venus' size and mass, its volcanoes probably produced much more water vapor than volcanoes on Earth did.

(B) The low temperature of Venus' early atmosphere can be explained only by the presence of water.

(C) The presence of carbon dioxide in a planet's atmosphere is an indicator of water on that planet.

(D) Venus probably was struck by roughly as many comets as Earth was.

35. The word "luminous" in the passage is closest in meaning to

(A) dense

(B) bright

(C) huge

(D) confused